Analysis of Draft Tank Closure and Waste Management Environmental Impact Statement for Hanford Site, Richland Washington DOE/EIS-0391

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Presentation Overview of ERWM Findings

- This is a summary to date of the Nez Perce Tribe ERWM findings on TC&WM EIS. This represents ERWM analysis of specific EIS comments only and is not the official policy of the Nez Perce Tribe.
- Modeling does not agree with current day data.
- Tank heel calculations low by a factor of 5-6 for heavy elements.
- Non-EIS total uranium source term is low by factor of 24.5 X.
- Total site risk did not take uranium long term analysis into account; 10,000 years versus 30,000 years.
- Recommendations

Groundwater Modeling Does Not Agree With Current Data

- We believe that the reasons that uranium, Tc-99, and nitrate activities/concentrations are currently at higher levels than expected is that the use of a Kd = 0.6 for uranium is inappropriate and water used during Hanford Operations was not incorporated into the model. *Technical Guidance Document for "Tank Closure Environmental Impact Statement" Vadose Zone and Groundwater Revised Analyses* should be revised to address these issues.

- Use of Kd is an approximation at best of non-homogeneous soils and is not representative of contaminant movement especially at timescales of thousands of years. Example: uranium in the B-BX-BY area (B Barrier) that far exceed the maximum predicted results reported in Tables O-6 and O-7. (no action alternative)

- DOE's continued inability to explain the current sources of groundwater contamination at Hanford undermines the credibility of the *TC & WM EIS* analyses, which rely on various modeling approaches to predict the consequences of RPP mission activities.

Groundwater Modeling Does Not Agree With Current Data

- Measured and predicted activity for technetium-99 for the BY Cribs are not "in general agreement." This comparison suggests that the set of values for the vadose zone hydraulic parameters have underestimated the flux of Tc-99 through the vadose zone from discharges to the BY Cribs.

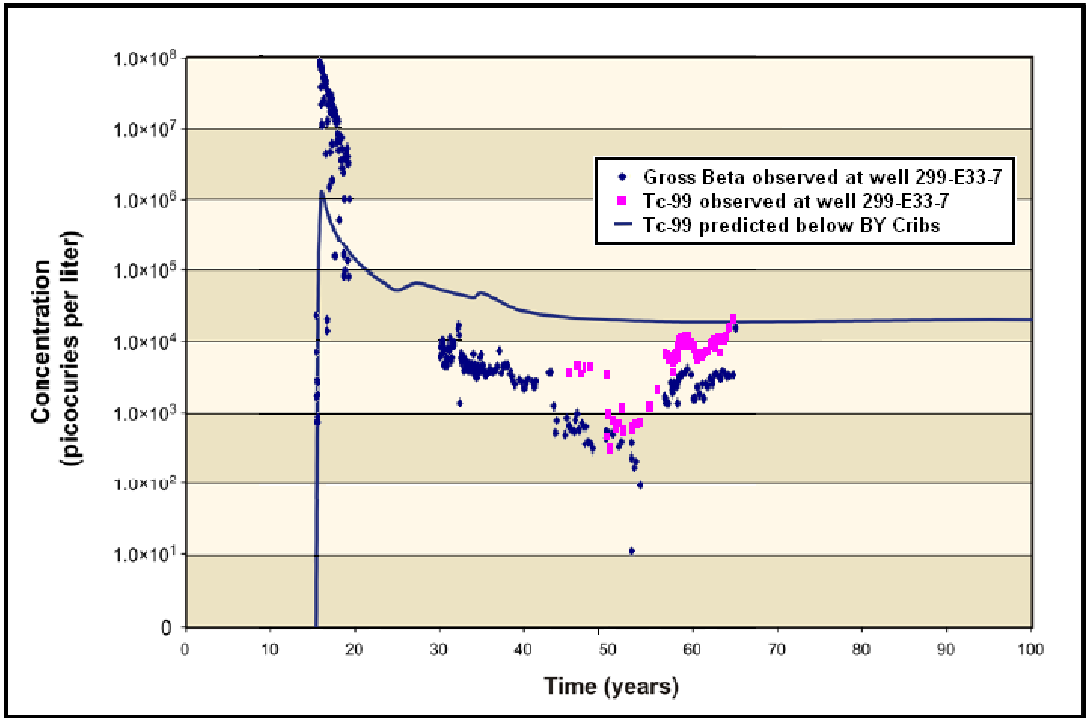


Figure N–5. Time Series of Measured Gross Beta Activity Below the BY Cribs
Figure N–6. Time Series of Predicted Concentration of Technetium-99 Below the BY Cribs

Observed versus predicted Tc-99 activity in groundwater below the BY Cribs as shown in the EIS. Figure N-5 is superimposed on Figure N-6

Tank Heel Calculations Low by a Factor of 5-6 for Heavy Elements

- Tank heel calculation were given in appendix D-16. There are 3 methods given:
  - Method 1 the tank heel is calculated as homogeneous used by EIS
  - Method 2 the tank heel is calculated based on the sludge remaining in the bottom of the tank. This was done by ERWM using 2009 BBI
  - Method 3 uses the Hanford Tank Waste Operations Simulator Model
- Analysis using method 2 gives indicates tank heel sludge have a higher content of uranium, plutonium, lead, mercury, PCBs, strontium-90 and a lower content of carbon-14, technetium-99, iodine-129, cesium-137, chromium and nitrate. The predominate impact is 6-7 times more uranium in the tank heel.
- Partial review of method 3 indicated DOE is fudging numbers to give lower heel totals. (average heel was 3% but lower total in tanks)

Tank Heel Calculation

Analyte Ci or Kg	90% EIS	90% #2	#2/EIS 90%	99% EIS	99% #2	#2/EIS 99%	99.9% EIS	99.9% #2	#2/EIS 99.9%
Hydrogen-3	8.93E+02	2.25E+02	0.25	8.93E+01	2.20E+01	0.25	8.93E+00	2.26E+00	0.25
Carbon-14	2.59E+02	2.74E+01	0.11	2.59E+01	1.98E+00	0.08	2.59E+00	2.54E-01	0.10
Strontium-90	3.43E+06	5.41E+06	1.58	3.43E+05	8.95E+05	2.61	3.43E+04	1.63E+05	4.75
Technetium-99	1.55E+03	8.32E+02	0.54	1.55E+02	6.30E+01	0.41	1.55E+01	1.13E+01	0.73
Iodine-129	2.99E+00	1.04E+00	0.35	2.99E-01	8.26E-02	0.28	2.99E-02	1.16E-02	0.39
Cesium-137	1.61E+06	1.26E+06	0.78	1.61E+05	1.31E+05	0.82	1.61E+04	2.40E+04	1.49
Uranium-233,234,235, 238	8.75E+01	1.71E+02	1.95	8.75E+00	3.12E+01	3.56	8.75E-01	3.93E+00	4.49
Neptumium-237	5.89E+00	4.69E+00	0.80	5.89E-01	3.83E-01	0.65	5.89E-02	1.22E-01	2.08
Plutonium-239,240	6.69E+03	6.60E+03	0.99	6.69E+02	9.77E+02	1.46	6.69E+01	1.73E+02	2.58
Chromium	4.95E+04	4.52E+04	0.91	4.95E+03	4.14E+03	0.84	4.95E+02	5.59E+02	1.13
Mercury	1.68E+02	3.79E+02	2.25	1.68E+01	6.29E+01	3.74	1.68E+00	9.98E+00	5.94
Nitrate	5.18E+06	3.81E+06	0.74	5.18E+05	3.18E+05	0.61	5.18E+04	4.64E+04	0.90
Lead	7.16E+03	1.31E+04	1.83	7.16E+02	1.77E+03	2.47	7.16E+01	2.61E+02	3.65
Uranium	5.42E+04	1.51E+05	2.79	5.42E+03	3.62E+04	6.67	5.42E+02	4.80E+03	8.86
PCB	8.54E+01	2.82E+02	3.30	8.54E+00	3.28E+01	3.84	8.54E-01	6.36E+00	7.45

Total Tank Farm vs. Retrieval

Analyte Ci or Kg	90% EIS	90% #2	#2/EIS 90%	99% EIS	99% #2	#2/EIS 99%	99.9% EIS	99.9% #2	#2/EIS 99.9%
Hydrogen-3	7.11E+03	6.22E+03	0.88	6.03E+03	5.94E+03	0.99	5.92E+03	5.91E+03	1.00
Carbon-14	3.93E+02	1.44E+02	0.37	1.12E+02	8.67E+01	0.77	8.39E+01	8.15E+01	0.97
Strontium-90	6.31E+06	1.77E+07	2.80	1.76E+06	3.69E+06	2.10	1.32E+06	1.57E+06	1.19
Technetium-99	3.58E+03	3.24E+03	0.90	9.10E+02	8.48E+02	0.93	6.43E+02	6.42E+02	1.00
Iodine-129	5.92E+00	4.04E+00	0.68	1.58E+00	1.39E+00	0.88	1.15E+00	1.14E+00	0.99
Cesium-137	5.35E+06	4.99E+06	0.93	1.22E+06	1.19E+06	0.97	8.10E+05	8.17E+05	1.01
Uranium-233,234,235, 238	1.34E+02	2.43E+02	1.81	4.99E+01	7.57E+01	1.52	4.15E+01	4.49E+01	1.08
Neptumium-237	1.71E+01	3.27E+01	1.91	4.43E+00	7.11E+00	1.61	3.16E+00	3.51E+00	1.11
Plutonium-239,240	1.01E+04	1.61E+04	1.59	2.77E+03	3.87E+03	1.40	2.03E+03	2.22E+03	1.09
Chromium	1.56E+05	1.74E+05	1.12	1.02E+05	1.03E+05	1.01	9.65E+04	9.68E+04	1.00
Mercury	2.53E+02	5.87E+02	2.32	8.87E+01	1.47E+02	1.66	7.23E+01	8.19E+01	1.13
Nitrate	3.36E+07	3.17E+07	0.94	2.72E+07	2.70E+07	0.99	2.66E+07	2.66E+07	1.00
Lead	1.32E+04	2.41E+04	1.82	5.68E+03	7.25E+03	1.28	4.92E+03	5.16E+03	1.05
Uranium	9.76E+04	2.21E+05	2.27	4.40E+04	7.81E+04	1.78	3.86E+04	4.32E+04	1.12
PCB	1.79E+02	3.45E+02	1.93	2.70E+01	5.24E+01	1.95	1.18E+01	1.74E+01	1.48

TC&WM EIS Chemical Cumulative Impact Does Not Take Into Account 96% of the Uranium on Site

- Appendix S lists radionuclide and chemical inventories for consideration in cumulative impact analysis, EIS plus non-EIS inventory.
- Some of the solid waste burial sites are taken into consideration for radionuclide inventory. None of the solid waste burial sites are taken into consideration for chemical inventory.
- Appendix S chemical inventory lists "Total Uranium (soluble salt)" for total uranium. This ignores the possibility that uranium will dissolve and be mobilized over the 10,000 to 30,000 years the EIS considers for uranium. The vast majority of uranium not considered for chemical hazards is buried in unlined trenches in containers of all types.

Table S–76b. Map 10: Chemical Inventories (kilograms)

WIDS ID/ Building Number	Common Site Name	Source Type	Hydrazine/Hydrazine Sulfate	Lead	Manganese	Mercury	Molybdenum	Nickel (soluble salt)	Nitrate (includes nitrate, nitrate from HNO_3, and nitrate from NO_2)	Polychlorinated Biphenyls	Silver	Strontium (stable)	Trichloroethylene	Total Uranium (soluble salt)	Vinyl Chloride
600-148	Environmental Restoration Disposal Facility	S	–	–	–	–	–	–	–	–	–	–	–	–	–
N/A	US Ecology	S	–	–	–	–	–	–	–	–	–	–	–	–	–
216-W-LWC	216-W-LWC Crib	L	–	1.09×10^{2}	6.71×10^{1}	3.13×10^{-1}	–	4.89×10^{1}	1.38×10^{3}	–	–	–	–	2.87	–
216-U-17	216-U-17 Crib	L	–	–	5.39×10^{-2}	1.72×10^{-2}	–	3.30×10^{-1}	9.08×10^{4}	–	–	–	–	2.46×10^{-1}	–

Uranium Available to Vadose Zone is 24.5 times Greater Than Given in EIS

- Below is a table of the some major sources of uranium from PNNL-15289 and TC&WM EIS and totals for all non-EIS sites.

Site	PNNL-15289 Curies				EIS Curies U	Calculated Kg U PNNL-15289	Kg U EIS
	U 233	U235	U234/238	Total Curies			
US Ecology	0	30.58	1789.10	1819.68	1820.00	4242898	0
218-W-5	0.32378	18.41	657.34	676.07	654.00	1001214	0.055
218-W-4A	0	6.97	329.19	336.16	132.00	500359	0
218-W-3AE	0.20185	4.01	246.92	251.13	185.00	374747	0
218-W-4C	3.02E-06	0.79	77.50	78.29	72.80	117402	83.5
218-W-3	0	0.98	46.12	47.09	23.50	70093	0
218-W-3A	0	0.82	38.95	39.77	0.00	59197	0
618-11	0	0.74	34.94	35.68	0.00	53110	0
221-U	0	0.63	29.55	30.18	0.00	44917	0
216-A-19	2.19E-05	0.63	28.70	29.33	29.30	42493	43400
316-1	68.571	0.40	19.26	88.23	84.50	29278	26200
216-U-8	1.17E-05	0.37	16.95	17.32	17.20	25765	25500
316-2	49.744	0.30	14.29	64.33	61.60	21727	19400
216-B-12	6.52E-06	0.22	10.03	10.24	10.20	15241	15100
216-A-25	0.000569	0.21	9.01	9.22	9.23	13705	12200
618-9	0	0.12	5.90	6.02	0.00	8968	0
Site Total	142.63	67.19	3400.62	3610.43	3220.00	6.69E+06	2.73E+05

TC&WM EIS Does Not Take Into Account Peak Exposure to Uranium as Detailed in Appendix O

- Modeling of uranium did not show peak concentration in groundwater or river's edge water in 10,000 years.
- In appendix O modeling was extended to 30,000 years.
- Near site results (S Barrier) were similar for 10,000 and 30,000 years. Core and Columbia River were an order of magnitude higher for the 30,000 year run. This was not taken into account in any of the ecological or human long term hazard analysis.
- Appendix O assumes flux into the vadose zone was complete in 10,000 years for both the 10,000 and 30,000 year analysis. This is true for tank leaks, cribs or trenches. This would not be true for waste sites such as capped solid waste burial grounds. Flux would continue throughout the entire time frame allowing a significant portion of the total uranium to be released to groundwater and Columbia river.

TC&WM EIS Does Not Take Into Account Peak Exposure to Uranium as Detailed in Appendix O

Standard (10,000 years)	Modified (30,000 years)
Flux in = 2.97×10^1 curies	Flux in = 2.97×10^1 curies
Flux out = 1.05×10^1 curies	Flux out = 2.81×10^1 curies
Accumulated solute = 1.93×10^1 curies	Accumulated solute = 1.65 curies
Decay (percent) = 4.04×10^{-5}	Decay (percent) = 5.69×10^{-5}
Release to groundwater = 1.02×10^1 curies	Release to groundwater = 2.8×10^1 curies
Release to Columbia River = 2.83×10^0 curies	Release to Columbia River = 2.50×10^1 curies
S Barrier = 2.12×10^2 pCi, 393 ppb	S Barrier = 2.40×10^2 pCi, 445 ppb
Core Zone = 4.82×10^2 pCi, 893 ppb	Core Zone = 1.36×10^3 pCi, 2520 ppb
Columbia River = 5.05 pCi, 9.4 ppb	Columbia River = 1.52×10^1 pCi, 28.2 ppb

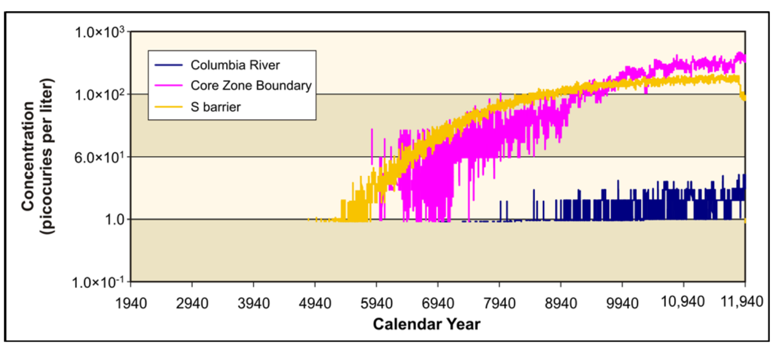


Figure O–45. Concentration of Uranium-238 for Standard 10,000-Year Period

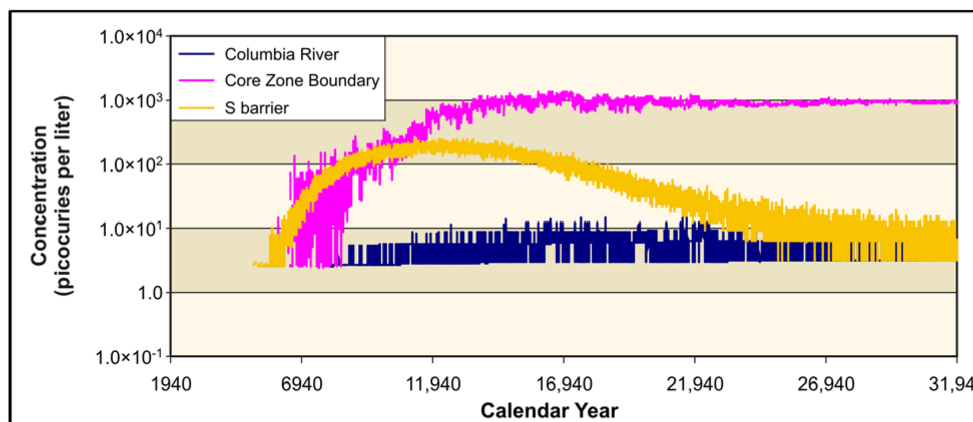


Figure O–46. Concentration of Uranium-238 for Modified 30,000-Year Period

Appendix O With Site Uranium Taken Into Account

Modified (30,000 years)	Modified (30,000 years) with All Uranium
Flux in = 2.97×10^{1} curies	Flux in = 1.80×10^{3} curies (50% in 30k yrs)
Flux out = 2.81×10^{1} curies	Flux out = 1.70×10^{3} curies
Accumulated solute = 1.65 curies	Accumulated solute = 1.0×10^{2} curies
Decay (percent) = 5.69×10^{-5}	Decay (percent) = 5.69×10^{-5}
Release to groundwater = 2.8×10^{1} curies	Release to groundwater = 1.69×10^{3} curies
Release to Columbia River = 2.50×10^{1} curies	Release to Columbia River = 9.9×10^{2} curies
S Barrier = 2.40×10^{2} pCi, 445 ppb	S Barrier = approximately the same
Core Zone = 1.36×10^{3} pCi, 2520 ppb	Core Zone = 5.38×10^{4} pCi, 99700 ppb
Columbia River = 1.52×10^{1} pCi, 28.2 ppb	Columbia River = 6.01×10^{2} pCi, 1110 ppb

Assumes 50% released to mobile vadose in 30,000 years.

Assumes 33% reduction of amount Uranium reaching river in 30,000 years.

Even if the local U concentrations are much less the entire Hanford groundwater supply will be contaminated. This may last for 100,000 years.

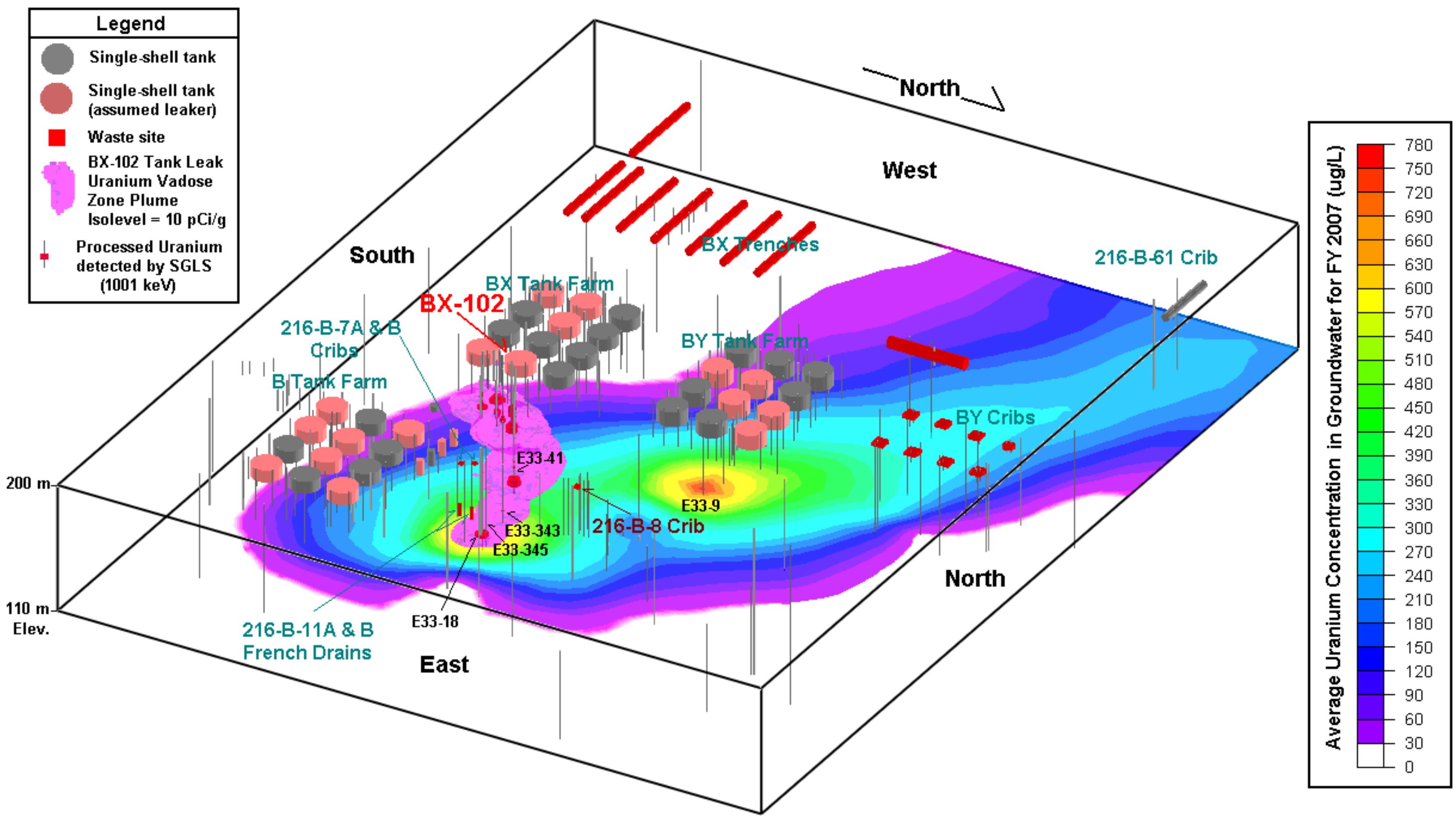
Recommendations

- Generally the feeling is the EIS will go well for tanks but the site as a whole will fail to meet objectives.
- Remediation should include all risks and be focused on risk reduction for the whole site.
- Pump and treat will not be enough. Caps will not help in long run.
- Focus must include solid waste burial grounds and US Ecology.
- DOE should find an acceptable glass for iodine. Work is in progress.
- DOE should consider alternative cleaning agents for tanks. Oxalic acid is 1940s technology.
- DOE should consider in-situ soil cleaning and sub-surface barriers in the EIS.
- Technetium-99 removal is preferred.
- EIS option 2B with higher tank cleaning rate is preferred.
- EIS option 6B for soil washing capability for mostly solid waste burial grounds is needed.

Recommendations continued

- Due to its location no expansion of IDF should be planned. The planned RRPDF should be relocated to 200 West in the proposed IDF West location.
- Soil cleaning of tank BX102 would be included and possibly one other tank area.
- Digging up associated cribs would not be considers due to lack of impact. (about 60 Kg uranium)
- Digging up crib 216-A-19 (cold run crib) should be considered for impact.
- We support DOE’s Preferred Alternative for FFTF Decommissioning, which is Alternative 2, Entombment.
- Ideally solid waste burial grounds would be dug up, washed and converted to glass to go offsite.
- US Ecology is small enough site that it could be slant drilled (oil rigs) to make a grout bathtub. This site could be dug up in the future.

Visualization of the BX-102 Tank Leak



Development of the Uranium Groundwater Plume in the B-BX-BY Area

(Drinking Water Standard = 30 ug/L)